

Abstract

Title: Modulation transfer function of active pixel focal plane arrays
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Modulation Transfer Function (MTF) is an important figure of merit in focal plane array sensors, especially for target trackers such as star trackers. In-situ evaluation in different stages of imager system developments for different sensors and their signal processing design, and understanding the tradeoff between different figures of merit will enable designers ^{to} achieve better designs in the future space missions.

An advanced active pixel sensors ^g has been designed and fabricated where different pixel shapes were placed, i.e. square, rectangular, and "L" shaped sensors. Research on analyzing the MTF for the general pixel shape is currently in progress. Explicit formulas for the modulation transfer function have been derived for the rectangular shaped pixel array. With this sensor, comparison can be made of the different figures of merit - fill factor (sensor geometry) and signal to noise ratio (electrical), for the same pixel size. MTF will give us a more complete understanding of the tradeoffs opposed by the different pixel designs. Therefore, testing the pixel shape impact on the MTF is an important issue.

In this paper, a preliminary results of the JPL developed silicon APS focal plane array will be presented in terms of sensor responsivity at room temperatures using a micron size laser beam that sans in less than a micron step. This can be achieved by applying a modified knife-edge technique to the existing MEALS system. By utilizing this knife edge technique, only a single image containing a rising or falling edge is needed to perform the measurement in each direction rather than conventional bar target of slit scanning. An estimate of the MTF profile for all spatial frequencies can be derived from this one edge image.

Key words:

Modulation transfer function, focal plane array, sensor responsivity, cross-talk, star trackers, active pixel sensor.